

variability of magnitude exhibited by minor planets is accepted as evidence of dissymmetry, and this, in turn, is taken as evidence for the initial cataclysm as described. Torn by tidal stress, the dark sun was disrupted while still solid, the dissymmetry showing that the asteroids have never been in a fluid state.

Jupiter as a semi-sun is discussed at some length, its albedo of 0.75, as compared with Muller's 0.72 for clouds, being ascribed as possibly due to intrinsic light; the same explanation is offered for Saturn's albedo of 0.78. Jupiter's independence of the sun—its belts of cloud are apparently not affected by the rotation or revolution of the planet—serves as an illustration of the earlier condition of the earth, and other planets, before the advent of the sun-sustained period.

Of Saturn and Uranus but little is related, but the story of Neptune's discovery is told at some length. Rather more stress than usual is laid on Prof. Pierce's demonstration that Galle's discovery was a lucky accident. The problem solved by Leverrier and Adams was capable of three solutions, and it was but by chance that they attacked the right one.

"Congruities" is the keynote for the chapter on the formation of planets, and Prof. Lowell urges that incongruities, discovered since Laplace's time, have killed the nebular hypothesis. He then marshals the mutually-sustaining facts in support of the planetesimal hypothesis. By curves showing the masses of the planets relative to their solar distance, and others demonstrating the analogies of satellites and primaries in their departures from the common plane, he shows that the congruities, on this hypothesis, are perfect—to-day; future discoveries may necessitate further steps.

Having thus brought us to the formation of planets as discrete bodies, the author proceeds to outline the probable history of the finished sphere. On the one hand, we have the physical development, the cracks and cataclysms which formed our geographical features along lines necessarily different from those obtaining on Mars, or any other world; on the other is the chemical development, "as universal as the universe itself." Evidence that darkness was spread over the face of the earth is gleaned from many quarters, all showing that our planet was a sunless forcing-house; this was the self-sustained age. Then the earth cooled, the dense cloud covering condensed, admitting sunlight, and we arrived at the sun-sustained epoch which we still enjoy. Here the story of evolution is exceedingly interesting, especially that dealing with the Ice age. Probably the statements will be criticised by some geologists, but the author's substitute for what he terms their "astrocomico" suggestions is none the less attractively stated. The extraordinary ellipticity of the orbit, to account for the Glacial epoch, is rejected, and is replaced by one in which excessive evaporation and precipitation, producing polar ice-sheets of great thickness, play a great part. It is also shown that the glaciation was restricted to well-marked raised areas, such as Norway, Scotland, Labrador, Keewatin, &c., and was nothing more than a natural terrestrial phenomenon; observations of Mars show that, at the present time,

the polar highlands retain their covering of snow for some time after the general melting of the cap has separated them from the main body of it.

In the last chapter the "Death of a World" is discussed, and the possible modes of extinction examined. It may be by collision with a dark sun, but, failing that, it is inevitable by the action of tidal friction and the diffusion of water and atmosphere. Collating the facts gleaned from the previous study of the several planets, it is shown that there is a more or less orderly sequence culminating in the present condition of our own satellite. *Sans* season, *sans* day and night, *sans* water and *sans* atmosphere, the worlds will await the quickening which can only come by the advent of a cataclysm such as is described in the earliest chapters.

The printing and illustration of the volume are beyond criticism, although the paper is rather heavy, and with its graphic language, its sustained interest, and clear story, the book is sure to appeal to the general reader who would learn more of the past, and of the probable future, of our earth and its fraternity.

WILLIAM E. ROLSTON.

NATURE-STUDY.

- (1) *The Nature-Study Idea. An Interpretation of the New School-movement to put the Young into Relation and Sympathy with Nature.* By L. H. Bailey. Third edition, revised. Pp. ix+246. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1909.) Price 4s. 6d. net.
- (2) *Man and Nature on Tidal Waters.* By Arthur H. Patterson. Pp. xvi+315. (London: Methuen and Co., 1909.) Price 6s.
- (3) *Tommy's Adventures in Natureland. A Nature Story for Boys and Girls.* By Sir Digby Pigott, C.B. Pp. xvi+180. (London: Witherby and Co., 1909.) Price 2s. 6d. net.
- (4) *Animal Romances.* By Graham Renshaw. Pp. vi+206. (London: Sherratt and Hughes, 1908.) Price 7s. 6d.

(1) **PROF. L. H. BAILEY** is well known as a botanist who believes in the practical and educational value of his science, and he has shown himself on many occasions able to give good reasons for the faith that is in him. In the present volume he discusses, in a lively and unconventional fashion, the true inwardness of "nature-study," which is not science, nor knowledge nor facts. "It is spirit. It is an attitude of mind. It concerns itself with the child's outlook on the world." "It would be better if it were called nature-sympathy." We do not think that professional educationists will quite agree with Prof. Bailey in associating all the pædagogical virtues with nature-study (for many of them may be expressed in the study of history, for instance), but most who have any sympathy at all with studying the world around us will agree with the sound educational sense which the book expresses. In a breezy and interesting fashion he discusses how nature-study may be taught, the school-garden, the rural-school problem, the teacher's outlook on nature, and about half a

hundred particular inquiries, some of which are very quaint, e.g. "Now that there are so many nature-books, how shall I choose the most useful one?" or, already, "Is nature-study on the wane?"

(2) Mr. Arthur H. Patterson has added a fourth volume to his series of east-coast books, and it is welcome, for the author writes with a light touch of the business of man and beast on the tidal waters of East Anglia. He describes at first hand much that is of interest regarding punt-gunning, decoying, snipe shooting, smelt fishing, shrimping, eel catching, and so on, and gives us delightful glimpses of the bird-life in particular. There is a great deal of fisherman's gossip in the book, but it is wholesome, open-air gossip, now and then cutting into the circle of the sciences.

(3) Sir Digby Pigott's nature-story for boys and girls is a sequel to "The Changeling," in which the author worked out, in a manner that pleased many, the idea of a child who was at one time a rook, at another a bee, at one time a fox, and at another a wild goose, and in due course a swift, a mole, and a short-eared owl. The author seeks to get young folks into close quarters with the real life of wild creatures, introducing them, through "Tommy's" adventures, to fur-seals and skuas, walrus and peregrines, and even to the dodo and "Archæopteryx." We find the book a little too informative, but it is kept, on the whole, commendably simple, and we doubt not that it may be useful for those children who really enjoy getting at things in this curiously circuitous fashion. The notes seem to us to be an artistic mistake.

(4) Dr. Graham Renshaw's natural-history essays are well known and justly admired, but he has excelled himself in the sequel, which deserves its title of "Animal Romances." With the help of more than a score of peculiarly interesting and artistic photographs, he has succeeded in giving us living pictures of many wild animals in their natural setting—giraffes ("the dream creatures," "the aristocrats"! Grevy's zebras ("the Horses of the Sun"), elephants ("the giants"), hippopotamus ("Behemoth"), and so on. He stays longest in Africa, but he takes us also to the Andes, to the Antarctic ice, to Tasmania, and elsewhere, and is always a lively guide. There is plenty of science in his nature-pictures, but there is poetry, too, and his book is literature of high quality.

TECHNICAL CHEMICAL ANALYSIS.

Technical Methods of Chemical Analysis. By Prof. George Lunge. English translation, edited by Dr. C. A. Keane. Vol. i., parts i. and ii. Pp. xxiv + 996. (London: Gurney and Jackson, 1908.) Price 2l. 12s. 6d. net.

A BOOK which covers such a wide ground as Prof. Lunge's "Technical Methods of Chemical Analysis" is by no means easy to review. No one chemist, for example, is likely to be practically conversant with all the branches of analysis which are dealt with, and, recognising this, the author has, as is usually the case in similar works, obtained those

who have specialised along certain lines to undertake the writing of such sections.

One of the difficulties to the reader of books like this is that to some extent it is a dictionary of methods, and it is sometimes a little bewildering to know which of many methods given for the analysis of one special substance is the best to employ. It is consequently not a book for the ordinary student, but one for the experienced worker, although even he will require to bring his critical faculty into play. The book is well written and is interesting to read, and those who study it will find it to contain quite an extraordinary amount of information which is by no means only analytical. The sections on clay and on clay wares, earthenware, and glazes are, for example, most interesting to read, even if one has no intention of carrying out the analysis. We like the arrangement of the section on potassium salts; first, all the methods employed are given in detail, and then the applications of these methods to special cases, such as analysis of Stassfurt salts, manures, beet ashes, and so on.

That the book is of the utmost value in the laboratory—in fact, almost indispensable—we can vouch, as since its publication it has been in constant use, and it is rarely that, within the scope of this volume, we have not obtained the information desired.

In conjunction with this volume an extremely useful little handbook of 260 pages, called "The Technical Chemist's Handbook," has also been issued. It is in limp cover, and of such a size that it can be carried in the pocket. Nearly 100 pages consist of tables, comprising, among others, factors for calculating gravimetric analysis, specific gravities, boiling points, tension of aqueous vapours, and weight of sheets of metals; there are, in fact, thirty-nine useful and valuable tables. The special part which follows deals with methods of analysis under various headings. To take an example at random, "III. Saltcake and Hydrochloric acid; A. Salt, B. Saltcake, C. Chimney-testing, D. Testing of the Gases in the Hargreaves Process, E. Hydrochloric acid." It should be mentioned that beside the thirty-nine tables referred to there are further tables in the special part, for example, the specific gravities of hydrochloric acid.

Dr. Lunge and Dr. Keane are to be congratulated on the issue of this volume, the one for writing it and the other for so ably editing the English edition. We hope that it will not be long before vols. ii. and iii. are ready.

BRITISH FOSSILS.

Palaeontographical Society. Vol. lxiii., 1909. (London: The Society, and Dulau and Co., Ltd.,

THE sixty-third volume of the Palaeontographical Society's monographs contains instalments of works already in progress, and the council announces its desire, so far as possible, of completing these before commencing new monographs, for which they have received numerous proposals.

Prof. S. H. Reynolds continues his monograph of the British Pleistocene mammalia, here dealing with